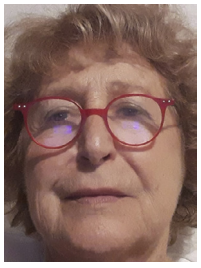
The quality of parenting in reproductive donation families: A meta-analysis and systematic review



BIOGRAPHY

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KEY MESSAGE

Parents using reproductive donation were able to establish a better quality of parenting than parents spontaneously conceiving, despite the absence of a genetic link with their children. The review provides valuable information for healthcare and medical professionals working with individuals facing complex and often conflicting decisions regarding medically assisted reproduction.

ABSTRACT

This review examined whether the absence of a genetic link with one or both parents in families using reproductive donation induced a different quality of parenting from that found in families with spontaneous conception or autologous assisted reproductive technology (AUT-ART), where the genetic mother carries the pregnancy and both parents have a genetic link with their children. MEDLINE, PsycINFO and PubMed were searched for English-language studies published from January 1993 to October 2021. A total of 45 studies were included in the systematic review, and 11 in the meta-analysis. The meta-analysis showed that in reproductive donation families, where there was no genetic link between parents and children, there were higher positive parental values ($P = 0.007$) and lower negative parental values ($P = 0.007$) than for parents and children in families that had spontaneously conceived. No statistically significant differences emerged when the reproductive donation families were compared with the AUT-ART families. The study showed that the quality of parenting was not conditioned by the presence or absence of a genetic link; instead, it was influenced by the processes underlying family building, such as the desire to have a child, the involvement of both parents in the childcare and the quality of disclosure.

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KEY WORDS

Donor insemination
Medically assisted reproduction
Oocyte donation
Parent–child relationship
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INTRODUCTION

In contemporary society in developed nations, a significant change concerning the 'traditional' family model is represented by the numerous family constellations (*Greenfeld, 2015*), including cis-heterosexual or homosexual reproductive donation families created through medically assisted reproduction (MAR). This choice involves the use of donated gametes (spermatozoa and/or eggs) or embryos and/or another woman hosting the pregnancy (surrogacy) for individuals who otherwise could not have conceived a child. In these new types of family (*Golombok, 2015*), where one or both parents do not have a genetic and/or gestational link with the child, the quality of parenting has often been questioned (*Casonato and Habersaat; 2015*; *Gurtin and Faircloth, 2018*); the main concern is that the absence of a genetic link may jeopardize the parent–child relationship (*Bos and Van Balen, 2010*; *Brewaeys, 2001*) leading to a less intimate relationship (*Dunn et al., 2002*), higher levels of conflict (*Hamilton et al., 2007*) or more frequent overprotective and overinvolved behaviours (*Burns, 2010*).

The concerns are based on the traditional belief that a genetic connection is critical to building and maintaining kinship relationships (*Carsten, 2003*; *Freeman, 2014*; *Kirkman, 2008*). Indeed, experiences of stigma related to non-genetic parenthood recur in cultures dominated by family narratives based on genetic ties (*Imrie and Golombok, 2018*; *Inhorn and Birenbaum-Carmeli, 2008*). Parents who have resorted to third-party reproduction must cope with the emotional and intellectual work necessary to feel they have the right to be the parents of a genetically unrelated child and to establish that genetic or gestational connections are not indispensable to determining parental status (*Imrie et al., 2020*; *Sandelowski et al., 1993*). The differences between national laws regarding which MAR procedures are allowed and who can access them signal caution in the appraisal of all the family types achievable through third-party donation (*Calhaz et al., 2020*).

Concerns are also expressed about the quality of parenting in homosexual or single-parent families who have chosen reproductive donation. Worries about the quality of parenting in homosexual families are due to the definition of parental roles between same-sex parents, the development of the children's sexual identity and the effects of social homophobic stigma, especially against the families of gay fathers (*Carone et al., 2018*, *2020*; *Tasker, 2010*). The skills of single parents, such as mothers who choose to use donor insemination techniques to achieve pregnancy or, more rarely, men who turn to surrogacy, may be adversely affected by the lack of a partner with whom to share the parenting tasks or by the possible disapproval of family and society (*Collins et al., 2000*; *Diez et al., 2021*). Moreover, the often advanced age of parents presents positive and negative aspects: the couples may have a more stabile relationship and a better economic status (*Bray et al., 2006*; *Duncan et al., 2018*), but, conversely, caring for the child may result in difficulty due to a lack of physical energy and reduced family support from the elderly grandparents (*MacDougall et al., 2012*; *Soderstrom-Antilla, 2001*; *Zweifel, 2015*).

Finally, keeping the secret about the non-genetic or non-gestational link with the child (*Tallandini et al., 2016*) may harm the relationship between the parents and children, as highlighted by both adoption studies and family therapy literature (*Baran and Pannor, 1993*; *Daniels et al., 2011*). Research has shown that the parents of children born via gamete donation and/or surrogacy might not inform their children about the circumstances surrounding their conception (*MacCallum and Keeley, 2012*; *Rosholm et al., 2010*). They often fear that disclosure will disturb the relationship with their children and undermine their development (*Readings et al., 2011*; *Salevaara et al., 2013*). However, in recent years, disclosure rates have been rising, reducing the possible impact of this secret on family relationships (*Hershberger et al., 2021*; *Indekeu et al., 2013*; *Soderstrom-Anttila et al., 2010*).

Assessing the quality of parenting in reproductive donation families is essential because the quality of parenting affects the children's psychological adjustment, cognitive and emotional skills, and ability to develop intimate relationships as adults (*Berk, 2017*; *Bowlby, 1977*; *Laursen and Collins, 2009*). Moreover, it can help to establish whether the lack of a genetic and/or gestational link between parents and children can negatively affect their relationship.

The research comparing the parenting quality between reproductive donation families (cis-heterosexual or homosexual) with families who conceived spontaneously or families using autologous assisted reproductive technology (AUT-ART), in which the mother carries the pregnancy and both parents are genetically linked with the child, have produced mixed results. In some research, the quality of parenting in spontaneous conception and AUT-ART families was the same as in those who had undergone reproductive donation (*Casey et al., 2013*; *Golombok et al., 2013*, *2017*; *Ilioi et al., 2017*; *Steiner et al., 2007*). Conversely, in some other studies, the quality of parenting appeared to be lower in families with spontaneous conception or AUT-ART families than those with reproductive donation (*Brewaeys et al., 1997*; *Golombok et al., 1996*, *2002a*, *2004a*, *2004b*, *2006b*; *Kovacs et al., 2013*; *MacCallum et al., 2007*, *2008*; *Owen and Golombok, 2009*; *Vanfraussen et al., 2003a*), while in still other studies the parenting was better than in reproductive donation families (*Golombok et al., 2011a*, *2011b*; *Imrie et al., 2019*).

This paper aims to provide an updated systematic review and the meta-analysis results of the published studies on the quality of parenting in reproductive donation families. The purpose of the review is to verify whether the absence of a genetic link for one or both parents influences the quality of parenthood, i.e. whether families who have undergone reproductive donation have a lower, higher or similar parenting quality to that of spontaneous conception or AUT-ART families.

MATERIALS AND METHODS

Selection criteria

Literature articles were selected if they met the following inclusion criteria:

(1) They were peer-reviewed studies about human reproduction written in English.
(2) They were quantitative studies with the methodology described in detail.
(3) The data differentiated between reproductive donation, AUT-ART and/or spontaneously conceived pregnancies.

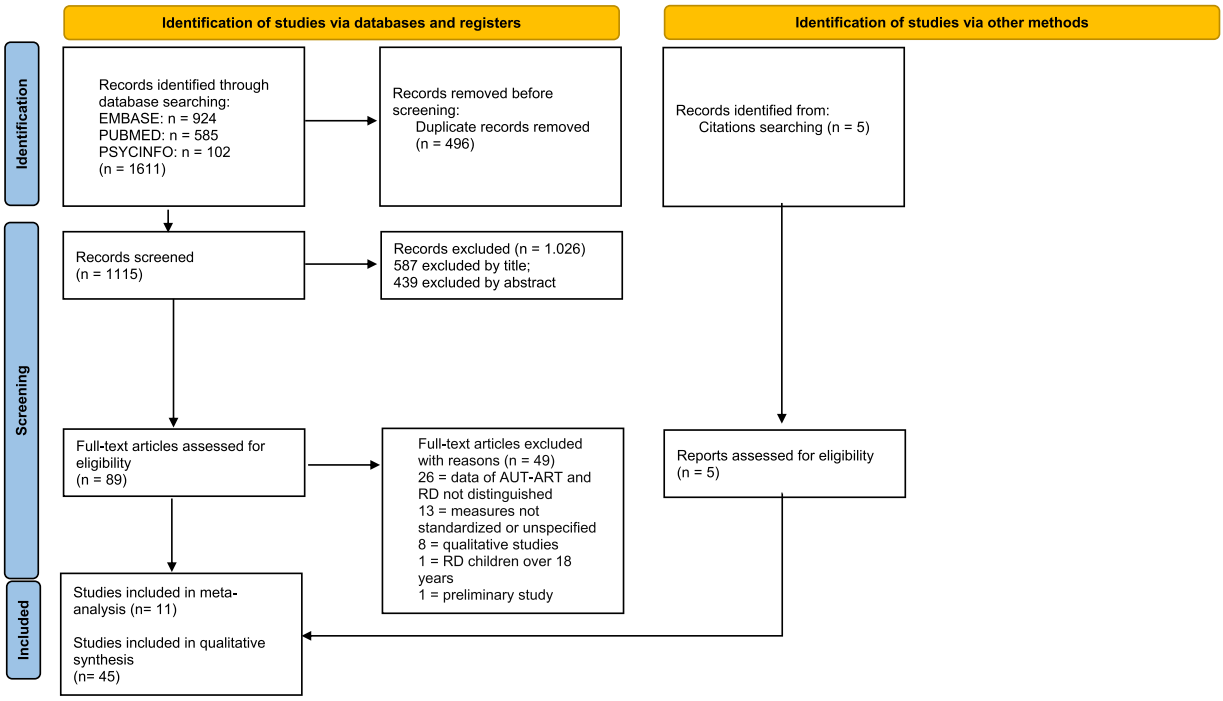

FIGURE 1 Flow chart of the selection of studies for inclusion in the systematic review and meta-analysis according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

(4) Data were collected from the start of pregnancy up to an age of the children not exceeding 18 years.
(5) The information related to parenthood was collected using standardized measures.

Search strategy

A literature search was conducted to retrieve articles published from 1993 to October 2021. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; *Page et al., 2021*) and Meta-analysis of Observational Studies in Epidemiology (MOOSE; *Brooke et al., 2021*) guidelines were followed. The PubMed/MEDLINE, EMBASE, PsycINFO search engines were used. The search terms used were: Parent-child relationship AND assisted reproductive technology. Based on the keywords mentioned above, 1611 records were found, of which 496 were duplicates and therefore removed, leaving 1115 records. A total of 587 articles were excluded based on the title and 439 based on the abstract.

Two authors (L.Z. and M.A.T.) examined studies that met the eligibility criteria and then cross-checked them. The disagreements (eight) were discussed until a consensus was reached.

The trial was registered with PROSPERO registration number CRD42021258510 (www.crd.york.ac.uk/PROSPERO).

Selection of papers

The 89 full-text selected papers were analysed in terms of the study design and types of measure of the parent–child relationship. According to the a priori criteria described above, 49 papers were excluded: 26 did not distinguish between data relating to AUT-ART families and data relating to reproductive donation families (criterion 3); in 13 papers, the measures used were not explicitly indicated or were not standardized (criterion 5); eight studies were qualitative (criterion 2); one study concerned children born after reproductive donation who were over 18 years of age (criterion 4); and another study included preliminary data that were later analysed in another publication (FIGURE 1).

After an analysis of the bibliographies of the selected articles five articles from other sources were added to the remaining 40 studies. Overall, 45 studies published between January 1993 and October 2021 met the review selection criteria.

Methodological quality appraisal

The risk of bias was estimated using the Quality Assessment of Diagnostic Accuracy Study checklist (QUADAS-2, *Whiting et al., 2011*). Two authors (L.Z. and L.R.R) independently assessed the risk of bias and applicability concerns for the included studies. The discrepancies were resolved through discussion with a third judge (M.A.T.).

Statistical analysis

Eleven studies were included in the meta-analysis and four separate meta-analyses were carried out. The standardized mean differences (SMD) for each study were combined using a random-effects meta-analysis (*Borenstein et al., 2009*). Inconsistency was assessed with a test for heterogeneity (an index with an acceptable value below 50% stated as moderate heterogeneity). The effect of the year of publication was assessed by a meta-regression.

RESULTS

Characteristics of the included studies

TABLE 1 shows the characteristics of the 45 papers reviewed. The types of reproductive donation investigated were: donor insemination in 37 studies, oocyte donation in 19, embryo donation in 2, double donation in 1 and surrogate motherhood in 10. The participants of 33 longitudinal studies were considered only once; these studies, which used a variety

TABLE 1 CHARACTERISTICS OF THE STUDIES INCLUDED IN THE SYSTEMATIC REVIEW

References	Child age	Sample size	Conception method	Measures	Tools	Administered to	Outcomes
Golombok et al. (1995)[a] UK	4–8 years	45 families	DI	Interviews	Quality of parenting	Mothers	The quality of parenting in ART (DI and AUT-IVF) families is higher than in SC families. SC parents reported statistically significant greater levels of parenting distress than ART parents, and AUT-IVF mothers more distress than DI mothers
		41 families	AUT-IVF	Questionnaire	PSI/SF	Mothers and fathers	
		43 families	SC	Tests	SAT; FRT; PSPCSA	Children	
		55 families	A				
Golombok et al. (1996)[a] UK/Spain/Italy/the Netherlands	4–8 years	111 families	DI	Interviews	Quality of parenting	Mothers	Mothers of ART children expressed greater warmth towards their child, were more emotionally involved, interacted more with them and reported less stress associated with parenting than SC mothers. ART fathers interacted more with their child and contributed more to parenting than SC fathers. DI parents did not differ from AUT-IVF for any of these variables
		116 families	AUT-IVF	Questionnaire	PSI/SF	Mothers and fathers	
		120 families	SC	Tests	FRT; PSPCSA	Children	
		115 families	A				
Cook et al. (1997) Eastern Europe (Bulgaria) and Western Europe (UK/Spain/Italy/the Netherlands)[a,b]	4–8 years	19 families	DI	Interview	Quality of parenting	Mothers	In Eastern Europe, ART parents (DI and AUT-IVF) had higher stress associated with parenting and greater difficulties in parental adjustment than Western European parents
		20 families	AUT-IVF				
		20 families	SC	Questionnaire	PSI/SF	Mothers and fathers	
		20 families	A				
		Western Europe (see *Golombok et al., 1996*)	DI; AUT-IVF; SC; A	Tests	FRT; PSPCSA	Children	
Brewaeys et al. (1997)[b] the Netherlands	4–8years	30 lesbian families	DI	Interviews	Quality of parenting	Mothers and fathers/co-mothers	The quality of the interaction between the social mother and the child in lesbian DI families was higher than between the father and the child in DI and SC heterosexual families
		38 heterosexual families	DI	Test	FRT	Children	
		30 heterosexual families	SC				
Nachtigall et al. (1997) USA	2–8 years	82 men and 94 women	DI	Questionnaires	Father-Child Activity Scale; Parental Attitudes Toward Child Rearing Scale	Mothers and fathers	Fathers who scored higher levels of stigma reported less parental warmth and fostering of independence: the perceptions of stigma may adversely affect the father–child relationship
Chan et al. (1998) USA	7 years	55 lesbian couples	DI	Questionnaire	PSI/SF; Life Scale of PSI	Mothers and fathers/ co-mothers	Parenting stress was significantly associated with children's externalizing behaviour problems
		25 heterosexual couples					
Golombok et al. (1999)[a,b] UK	4–8 years	45 families	DI	Interviews	Quality of parenting	Mothers	Parents in families where there was no genetic link between the mother and the child had greater psychological well-being than parents in families with a genetic link. The DI, OD and AUT-ART families did not differ with respect to the quality of parenting
		21 families	OD	Questionnaire	PSI/SF	Mothers and fathers	
		41 families	AUT-IVF	Test	PSPCSA	Children	
		55 families	A				
Golombok et al. (2002a)[a] UK Follow-up of *Golombok et al. (1995)*	12 years	37 families	DI	Interviews	Quality of parenting; CAFÉ	Mothers, fathers and children	DI mothers showed greater expressive warmth towards their children and DI fathers had less involvement in the discipline of their children than SC mothers and fathers
		91 families	SC	Questionnaires	EAI; CTS	Mothers, fathers and children	
		49 families	A				
Golombok et al. (2002b)[a,b] UK Spain/Italy/the Netherlands Follow-up of *Golombok et al. (1996)*	12 years	94 families	DI	Interviews	Quality of parenting; CAFÉ	Mothers, fathers and children	The few differences found between ART (DI and AUT-IVF) and SC families showed a better quality of parenting in ART families, except for emotional overinvolvement, which appears to be greater in ART families
		102 families	AUT-IVF				
		102 families	SC	Questionnaires	EAI; CTS	Mothers, fathers and children	
		102 families	A				

TABLE 1 *(continued)*

References	Child age	Sample size	Conception method	Measures	Tools	Administered to	Outcomes
Vanfraussen et al. (2003a) Belgium Follow-up of *Brewaeys et al. (1997)*	10 years	24 lesbian families	DI	Interview	Topic Interview	Couples and children	In the lesbian families there was a more egalitarian division of child-care responsibilities between parents compared with SC families. The quality of the children's relationship with the non-biological mother was similar to that with the biological mother
		24 heterosexual families	SC	Questionnaires	PACHIQ	Mothers, fathers/co-mothers and children	
Vanfraussen et al. (2003b) Belgium Follow-up of *Brewaeys et al. (1997)*	10 years	24 lesbian families	DI	Interview	Semi-structured interview on donor conception	Children	The desire to know more about the donor or the lack of this need was not related to the quality of the parent–child interaction
				Questionnaire	PACHIQ	Children	
Golombok et al. (2004a)[a,c] UK	9–12 months	50 families	DI	Interview	Quality of parenting	Mothers and fathers	Findings indicated more positive parent–child relationships among DI than SC parents, accompanied by greater emotional involvement with the child
		51 families	OD	Questionnaire	PSI/SF; AQ	Mothers and fathers	
		80 families	SC				
Golombok et al. (2004b)[c] UK	1 year	51 families	OD	Interview	Quality of parenting	Mothers and fathers	Parents in SM families reported lower levels of stress associated with parenting and showed greater warmth and better attachment behaviour toward their infants than SC parents. SM fathers were also more satisfied with the parental role than SC fathers
		42 families	SM	Questionnaire	PSI/SF; AQ	Mothers and fathers	
		80 families	SC				
Lycett et al. (2004) UK	4–8 years	46 families (28 non-disclosers and 18 disclosers)	DI	Interviews	Quality of parenting; BPI	Mothers, fathers and children	More positive parent–child relationships were found in disclosing than in non-disclosing families. However, this did not represent dysfunctional relationships in the non-disclosing families but more positive ratings in the disclosing group
Golombok et al. (2005)[c] UK Follow-up of *Golombok et al. (2004a)*	2 years	46 families	DI	Interview	PDI	Mothers and fathers	DI mothers showed greater pleasure in their child than SC mothers, accompanied by a perception of their child as more vulnerable
		48 families	OD	Questionnaire	PSI/SF; Vulnerable Child Scale	Mothers and fathers	
		68 families	SC				
Murray and Golombok (2005a) UK	6–12 months	27 solo mothers	DI	Interview	Quality of parenting	Mothers	Solo DI mothers showed lower levels of mother–child interaction and lower levels of sensitivity toward their infant than partnered DI mothers
		50 partnered mothers		Questionnaire	PSI/SF; AQ	Mothers	
Murray and Golombok (2005b) UK Follow-up of *Murray and Golombok (2005a)*	2 years	21 solo mothers	DI	Interview	PDI	Mothers	Solo DI mothers showed greater pleasure than partnered mothers in their child and lower levels of anger accompanied by a perception of the child as less 'clingy'
		46 partnered mothers		Questionnaire	PSI/SF; Vulnerable Child Scale	Mothers	
Murray et al. (2006)[a] UK Follow-up of *Golombok et al. (1999)*	12 years	35 families	DI	Interviews	Quality of parenting; CAFÉ	Mothers and children	No differences were found between OD and AUT-IVF families. There were lower levels of sensitive responding of OD mothers towards their children compared with DI mothers. DI mothers were more likely to be emotionally overinvolved with their child than OD mothers
		17 families	OD				
		34 families	AUT-IVF				
Golombok et al. (2006a)[c] UK Follow-up of *Golombok et al. (2004a, 2004b)*	2 years	48 families	OD	Interview	PDI	Mothers and fathers	SM mothers showed more positive representations of their relationship with their child than SC mothers. SM fathers reported lower levels of stress associated with parenting than SC fathers. There was a greater involvement in parenting by OD and SM mothers than fathers
		37 families	SM	Questionnaire	PSI/SF	Mothers and fathers	
		68 families	SC				
Golombok et al. (2006b)[c] UK Follow-up of *Golombok et al. (2004a, 2004b)*	3 years	41 families	DI	Interview	Quality of parenting	Mothers	DI, OD and SM mothers had higher levels of warmth and interaction with children than SC mothers
		41 families	OD				
		34 families	SM	Questionnaire	PSI/SF	Mothers and fathers	
		67 families	SC				

TABLE 1 *(continued)*

References	Child age	Sample size	Conception method	Measures	Tools	Administered to	Outcomes
MacCallum et al. (2007)[b] UK	2–5 years	21 families	ED	Interview	Quality of parenting	Mothers and fathers	ED mothers exhibited higher levels of defensive responses than AUT-IVF mothers. ED fathers showed greater emotional involvement than AUT-IVF fathers
		30 families	AUT-IVF	Questionnaire	PSI/SF	Mothers and fathers	
		28 families	A				
Steiner et al. (2007) US	1–7 years	18 mothers in their 50s	OD	Questionnaire	PSI/SF	Mothers	Women who chose to conceive after age 50 years did not appear to have significant differences in physical or mental functioning and did not suffer from greater degrees of parental stress than their younger counterparts
		24 mothers in their 40s	OD/AUT-IVF				
		22 mothers in their 30s	OD/AUT-IVF				
Weissenberg et al. (2007) Israel	2–7 years	26 single women	DI	Interview	CAFÈ	Mothers	Although the pleasure of motherhood was high, health problems were frequent for both mothers and children in families where mothers were on average 43 years old at the first birth
		25 single women 11 single women	IVF with donated sperm DD (IVF with donated sperm and oocytes)	Questionnaire	CTS	Mothers	
MacCallum et al. (2008) UK Follow-up of *MacCallum et al. (2007)*	5–10 years	17 families	ED	Interview	Quality of parenting	Mothers and fathers	ED families are generally functioning well, with psychologically well-adjusted parents forming warm relationships with their non-genetic child. Enjoyment of play and sensitive responding were higher in ED mothers than in AUT-IVF mothers
		28 families	AUT-IVF	Questionnaire	PSI/SF	Mothers and fathers	
		24 families	A				
Owen and Golombok (2009)[a] UK Follow-up of *Golombok et al. (1995)*	18 years	26 families	DI	Interview	Quality of parenting	Mothers and fathers	The level of mother–adolescent warmth was higher in DI families than in SC and AUT-IVF families. AUT-IVF mothers showed greater disciplinary indulgence than SC mothers and lower disciplinary aggression than DI mothers. No differences were identified between fathers for warmth or conflict
		26 families	AUT-IVF				
		63 families	SC	Questionnaires	PASAS; CBQ	Mothers and fathers	
		38 families	A				
Bos and Gartrell (2010) US	16–18 years	39 girls and 39 boys in lesbian families	DI	Questionnaire		Children	Adolescents who had a closer and more positive relationship with their mothers demonstrated greater resilience to stigmatization
Golombok et al. (2011a)[c] UK Follow-up of *Golombok et al. (2004a)*	7 years	36 families	DI	Interview	Quality of parenting	Mothers	The non-disclosing families had significantly lower scores than the SC families for both mother–child mutuality and maternal positivity
		32 families	OD	Observational assessment	Etch-A-Sketch Task	Mothers and children	
		54 families	SC				
Golombok et al. (2011b)[c] UK Follow-up of *Golombok et al. (2004b)*	7 years	32 families	OD	Interview	Quality of parenting	Mothers	No differences were found for maternal negativity or maternal positivity between OD, SM and SC mothers, although the SM and OD families showed less positive mother–child interactions than SC families
		32 families	SM	Observational assessment	Etch-A-Sketch Task	Mothers and children	
		54 families	SC				
Freeman and Golombok (2012) UK Follow-up of *Lycett et al. (2004)*	10–14 years	30 families	DI	Intreviews	Quality of parenting; CAFÉ	Mothers, fathers and children	While disclosure was associated with lower levels of conflict between mothers and sons, adolescents who were aware of their donor origins reported less warm father–child relationships than those who had not been told
Kovacs et al. (2013)[b] Australia	5–13 years	79 families	DI	Questionnaires	Family Assessment Device; Parenting Alliance Inventory; Parenting Involvement Scale; CRPR; C-PRS/SF	Mothers and fathers	DI families showed a higher level of family functioning. DI fathers reported a better quality of relationships with children than did stepfathers. Mothers in DI families reported a more positive relationship with children than single mothers
		987 families with heterosexual parents	SC				
		364 families with single mothers	SC				
		112 families with stepfathers	SC				

TABLE 1 *(continued)*

References	Child age	Sample size	Conception method	Measures	Tools	Administered to	Outcomes
Golombok et al. (2013)[c] UK Longitudinal study (see *Golombok et al., 2006a*, *2006b*, *2011a*, *2011b*)	3, 7 and 10 years	35 families	DI	Interview	Quality of parenting	Mothers	No differences between SM, OD, DI and SC families were found for maternal positivity, maternal negativity or maternal distress. However, a higher level of distress was shown by mothers who had not told their child about their biological origins
		31 families	OD				
		30 families	SM				
		53 families	SC				
Casey et al. (2013)[c] UK Follow-up of *Golombok et al. (2004a)*	7 years	24 families	DI	Interview	Quality of parenting	Fathers	Lower levels of parental distress were reported by DI fathers than OD or SC fathers. For the positive or discipline aspects of parenting there was no significant difference between family types. In observational assessment DI children displayed statistically significant greater negativity in the quality of interaction with their fathers than OD or SC children
		25 families	OD	Questionnaire	PSI/SF	Fathers	
		32 families	SC	Observational assessment	Co-construction Task	Fathers and children	
Blake et al. (2014a)[c] UK Longitudinal study (see *Golombok et al., 2004a*, *2005*, *2006b*, *2011a*)	1 year	50 families	DI	Interview	Donor Conception Interview	Mothers	Mothers and fathers in both DI and OD families were found to be psychologically well adjusted. Disclosure of the child's donor origins to the child was not always associated with optimal levels of parental psychological adjustment
		51 families	OD				
	2 years	46 families	DI				
		48 families	OD				
	3 years	41 families	DI				
		41 families	OD	Questionnaire	PSI/SF	Mothers and fathers	
	7 years	36 families	DI				
		32 families	OD				
	10 years	34 families	DI				
		30 families	OD				
Blake et al. (2014b)[b,c] UK Longitudinal study (see *Golombok et al., 2011*)	7 and 10 years	31 children	DI	Interviews	CAFÉ; Donor Conception Interview	Children	The absence of a genetic link between one parent and the child did not appear to affect the children's feelings of closeness to their parents
		28 children	OD	Tests	McArthur Story Stem Battery;	Children	
		51 children	SC				
Borneskog et al. (2014)[b] Sweden	12–36 months	131 lesbian parents	DI	Questionnaire	SPSQ	Mothers and fathers/co-mothers	DI lesbian parents experienced less parenting stress than heterosexual AUT-IVF parents and SC couples. Birth mothers experienced higher parenting stress than co-mothers and fathers
		83 heterosexual parents	AUT-IVF				
		118 heterosexual parents	SC				
Golombok et al. (2016) UK	4–9 years	51 solo mothers	DI	Interview	Quality of parenting	Mothers	For the positive parenting variables there was no difference between the solo mother and two-parent families. For the negative parenting variables battles between mothers and children were less frequent in solo mother than two-parent families
				Questionnaire	PSI/SF	Mothers	
		52 partnered mothers		Observational assessment	Etch-A-Sketch Task	Mothers and children	
Slutsky et al. (2016) USA	12–19 years	12 adolescents with single mothers	DI	Interview	Friends and Family Interview	Children	Teens with secure attachment were more interested in exploring the ways of their conception, those with insecure-avoidant attachment tended to express less curiosity and those with insecure-disorganized attachments tended to avoid issues related to their conception
		7 adolescents with lesbian mothers		Questionnaire	Donor Conception Identity Questionnaire		
Golombok et al. (2017)[b,c] UK Follow up of *Golombok et al. (2004a*, *2004b)*	14 years	32 families	DI	Interview	Quality of parenting	Mothers	SM mothers showed less negative parenting and reported greater acceptance of their children and fewer problems in family relationships than OD and DI mothers. Less positive relationships were found in OD families than in DI families
		27 families	OD	Questionnaires	IFR; PARQ; PCS	Mothers and children	
		28 families	SM	Observational assessment	Vacation planning task	Mothers and children	
		54 families	SC				

TABLE 1 *(continued)*

References	Child age	Sample size	Conception method	Measures	Tools	Administered to	Outcomes
Ilioi et al. (2017)[c] UK Follow-up of *Golombok et al. (2004a, 2004b)*	14 years	32 families	DI	Interview	Quality of parenting	Mothers	Adolescents who were unaware of their biological origins did not differ from adolescents who had been told about the circumstances of their birth, or from SC adolescents, in terms of psychological well-being or quality of family relationships. More positive outcomes were found for adolescents who had been told before age 7 years
		27 families	OD	Questionnaires	IFR; PARQ; PCS	Mothers and children	
		28 families	SM	Observational assessment	Vacation planning task	Mothers and children	
		54 families	SC				
Zadeh et al. (2017) UK Follow-up of *Golombok et al. (2016)*	7–13 years	19 children with single mothers	DI	Interviews	Friends and Family Interview; Donor Conception Interview	Children	Children with a high level of secure-autonomous attachment to the mother were more likely to have a positive perception of the donor, while those with an insecure-disorganized attachment perceived it more negatively
Carone et al. (2018) Italy	3–9 years	40 gay families	SM plus OD	Interview	Quality of parenting	Fathers/mothers and co-parents	Higher levels of stigmatization were reported by gay fathers than by lesbian mothers. Negative parenting was a factor associated with children's externalizing problems
		40 lesbian families	DI	Observational assessments	Etch-A-Sketch Task; Co-Construction Task	Fathers/mothers/co-parents and children	
Golombok et al. (2018) US	3–9 years	40 gay families	SM	Interview	Quality of parenting	Fathers/mothers and co-parents	There were no differences between families with gay fathers or lesbian mothers in terms of quality of parenting and parent–child interaction. Children whose parents perceived greater stigmatization or experienced higher levels of negative parenting showed higher levels of externalizing problems
		55 lesbian families	DI	Observational assessments	Etch-A-Sketch Task; Co-Construction Task	Fathers/mothers/co-parents and children	
Imrie et al. (2019)[b] UK	6–18 months	85 families	OD with identifiable donors	Interview	PDI	Mothers and fathers	High-quality relationships in OD and AUT-ART families were found, but OD mothers had lower levels of parental confidence than AUT-IVF mothers, associated with their older age, and a lower quality of mother–infant interaction, in particular in OD families with twins
		65 families	AUT-IVF	Observational assessments	Free play task coded using Emotional Availability Scales	Mothers/fathers and children	
Sydsjö et al. (2019) Sweden	3 months – 5 years	18 heterosexual parent families	SM	Questionnaire	SPSQ	Mothers, fathers and co-fathers	Parenting stress levels in SM families were generally low and not related to sexual orientation. Gay fathers were significantly more open about using surrogacy compared with heterosexual parents
		12 gay father families					
Golombok et al. (2021) UK Follow-up of *Golombok et al. (2016)*	8–10 years	44 single mothers	DI	Interview	Quality of parenting	Mothers	There were no differences in maternal mental health and in the quality of mother–child relationships between single mothers and partnered mothers
				Questionnaire	PARQ	Mothers and children	
		37 partnered mothers		Observational assessment	Etch-A-Sketch Task	Mothers and children	

Families are cis-heterosexual unless specified.

[a] European Study of Assisted Reproduction Families.

[b] Study included in the meta-analyses.

[c] UK longitudinal Study of Reproductive Donation Families.

Type of reproduction: A, adoptive; ART, assisted reproductive technology; AUT, autologous; AUT-IVF, IVF without donor; DD, double donation DG, donor gametes; DI, donor insemination; ED, embryo donation; OD, oocyte donation; SC, spontaneous conception; SM, surrogate motherhood.

Parenting measures: AQ, Attachment Questionnaire; BPI, Berkeley Puppet Interview; CAFÉ, Child and Adolescent Functioning and Environment Schedule; CBQ, Conflict Behaviour Scale; C-PRS/SF, Child-Parent Relationship Scale, Short Form; CRPR, Child-Rearing Practices Report; CTS, Conflict Tactics Scale; EAI, Expression of Affection Inventory; FRT, Family Relations Test; IFR, Index of Family Relations; PACHIQ, Parent-Child Interaction Questionnaire; PARQ, Parental Acceptance-Rejection Questionnaire; PASAS, Parents of Adolescents Separation Anxiety Scale; PCS, Parental Control Scale; PDI, Parent Development Interview; PSI/SF, Parenting Stress Index, Short Form; PSPCSA, Pictorial Scale of Perceived Competence and Social Acceptance; Quality of Parenting, adaptation of the interview designed by *Quinton and Rutter (1988)*; SAT, Separation Anxiety Test; SPSQ, Swedish Parenthood Stress Questionnaire.

of methods and measures in the data collection (TABLE 1), were: the European Study of Assisted Reproduction Families (*Cook et al., 1997*; *Golombok et al., 1995*, *1996*, *1999*, *2002a*, *2002b*; *Murray et al., 2006*; *Owen and Golombok, 2009*); the UK longitudinal Study of Reproductive Donation Families (*Blake et al., 2014a*, *2014b*; *Casey et al., 2013*; *Golombok et al., 2004a*, *2004b*, *2005*, *2006a*, *2006b*, *2011a*, *2011b*, *2013*, *2017*; *Ilioi et al., 2017*); Brewaeys and colleagues (*Brewaeys*

et al., 1997; follow-up *Vanfraussen et al., 2003a*, *2003b*); Lycett and co-workers (*Lycett et al., 2004*; follow-up *Freeman and Golombok, 2012*); *Murray and Golombok (2005a*; follow-up *Murray and Golombok 2005b*); MacCallum and colleagues (*MacCullum et al., 2007*; follow-up *MacCallum et al., 2008*); and Golombok and collaborators (*Golombok et al., 2016*; follow-up *Golombok et al., 2021*; *Zadeh et al., 2017*).

The term 'family' was used to indicate a unit where mothers and/or fathers and children participated in the research. The number of reproductive donation families involved in the studies was as follows: 1007 donor insemination (plus 94 mothers and 82 fathers included in the study of *Nachtigall et al., 1997*, which did not specify how many families these participants corresponded to), 175 oocyte donation, 152 surrogate motherhood, 21 embryo donation and 11 double donation families. In all 152 families who had a surrogate motherhood, the child had a genetic link with the commissioning father, and only in 20 of them were the children also linked genetically to the commissioning mother.

Regarding the sexual orientations of the reproductive donation parents, 726 were cis-heterosexual couples (plus 94 women and 82 men from the study by *Nachtigall et al., 1997*), 152 were single mothers who used donor insemination, 396 were same-sex lesbian couples who used donor insemination and 92 were same-sex gay couples families who used surrogacy.

In terms of the control groups, 314 AUT-ART families and 1831 spontaneous conception families were involved.

The children's ages at the time of the research ranged from 3 months to 18 years.

Concerning the research country, 27 studies involved a sample from the UK, 6 from the USA, 3 from Belgium, 2 from Sweden and 1 from each of Australia, Italy and Israel. Three cross-cultural studies involved samples from the UK, Spain, Italy and the Netherlands, and in addition to these a sample from Bulgaria was included in one cross-cultural study.

Thirty-seven different measures (interviews, questionnaires, tests and observational measures) administered to mothers, fathers and children were employed to investigate aspects related to parenting (TABLE 1). The most used measure (27 studies) was the Quality of Parenting Interview, an adaptation of *Quinton and Rutter's (1988)* interview.

The variables were grouped into three clusters – positive parenting, negative parenting and mutuality, similar to the clusters used in the most recent research by *Golombok and colleagues (2017*, *2018*, *2021)*. The variables were independently assigned to each cluster by three external judges. The agreement level was 98%, and the few discrepancies were resolved through discussion.

The positive parenting cluster contained the variables characterized by warmth, closeness, pleasure in parenthood, and collaboration between the parents in the children's care. Higher values indicated a better quality of the parent–child relationship.

The negative parenting cluster grouped the variables characterized by conflict, hostility, control, overinvolvement and parenting distress. Higher values showed a worse relationship between the parent and the child.

Finally, the third cluster, mutuality, grouped the measures obtained by observing parent–child interactions, characterized by mutual responsiveness, mutual sensitive responses and dyadic cooperation. The higher the mutuality values, the better the interaction.

Risk of bias

Seven studies were considered at high risk of bias in the patient selection domain because the participants were recruited through a same-sex parent website and/or snowballing.

Due to the nature of the research, blinding was not applicable for the index test bias. The risk of bias was judged unclear in eight studies, where a percentage of interviews and observation recordings were assessed by a judge who did not know the method of the child's conception.

Finally, the risk of bias was assessed to be unclear in the flow and timing domain in 22 studies in which not all recruited patients were included in the analysis; in particular, 16 studies had a high percentage (ranging from 20% to 51.6%) of fathers who had not responded to all the measures administered.

No studies showed applicability concerns for any of the domains (TABLE 2 and Supplementary Data).

Meta-analysis

The meta-analysis aimed to test the quality of parenting. When the positive parenting in the reproductive donation families was significantly lower and the negative parenting higher than the values recorded for the spontaneous conception and AUT-ART families, it indicated that the parenting quality in the reproductive donation families was worse than that in the families in which a genetic link was present for both parents.

Four independent meta-analyses were carried out. Two aimed to compare the positive and negative parenting of parents with no genetic link in reproductive donation families with those of spontaneously conceiving parents. The other two compared the positive and negative parenting of parents with no genetic link in reproductive donation families with that of parents who used

TABLE 2 RESULTS OF RISK OF BIAS AND APPLICABILITY ASSESSMENT OF THE INCLUDED STUDIES

Category	Risk of bias				Applicability concerns		
	Patient selection	Index test	Reference standard	Flow and timing	Patient selection	Index test	Reference standard
Low	34	37	41	23	41	45	41
High	7	0	0	0	0	0	0
Unclear	4	8	4	22	4	0	4

The analysis was undertaken according to the Quality Assessment of Diagnostic Accuracy Study checklist (QUADAS-2).

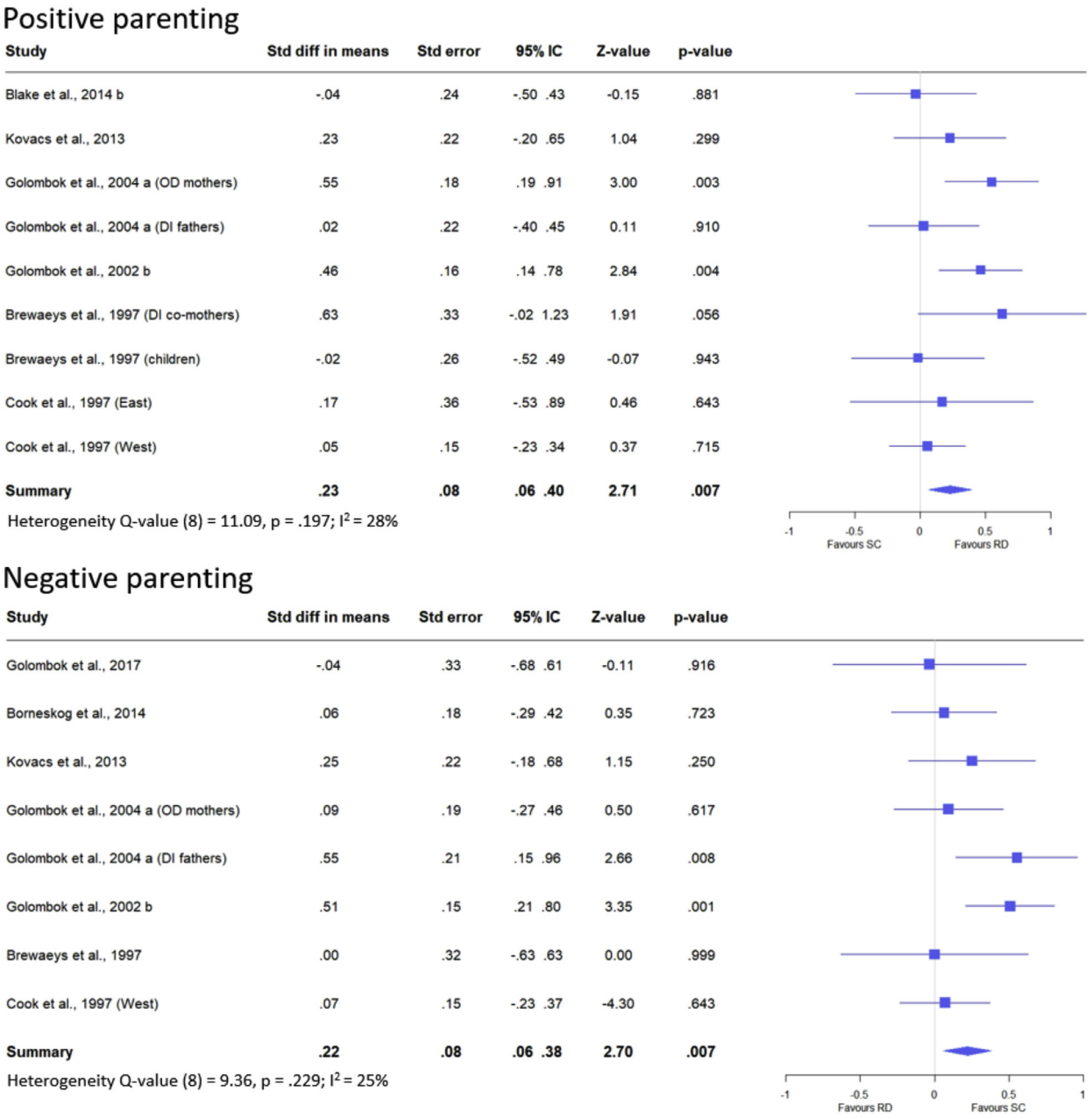

FIGURE 2 Meta-analysis of the positive and negative parenting values of parents with children without a genetic link in reproductive donation (RD) families compared with those of parents whose children have a genetic link in spontaneous conception (SC) families. Std, standard.

AUT-ART (i.e. families who underwent homologous MAR). It was impossible to perform a meta-analysis on the mutuality due to the insufficient number of papers using observational measures.

For reproductive donation families, data were recorded for fathers and co-mothers in donor insemination families, mothers in oocyte donation families, mothers and fathers in embryo donation families, and, in all types of families, the children concerning the parent with whom they had no genetic link. It was impossible to include the families with surrogate motherhood because the studies did not distinguish situations in which the genetic link was missing from those in which it was present, and because they did not have an spontaneous conception or AUT-ART control group.

The variables belonging to each cluster were ordered according to their frequency of use. For each study, the comparison between groups was summarized by calculating the SMD of the most frequent positive or negative parenting measures.

In the first pair of analyses, the SMD for positive and negative parenting in reproductive donation families were compared with the corresponding values for spontaneously conceiving families (FIGURE 2). The *I*-squared statistic showed an acceptable level of homogeneity (*I*-squared = 28) for positive parenting only. The *I*-squared statistic was higher than 50% for negative parenting (*I*-squared = 74.42). Cook and colleagues

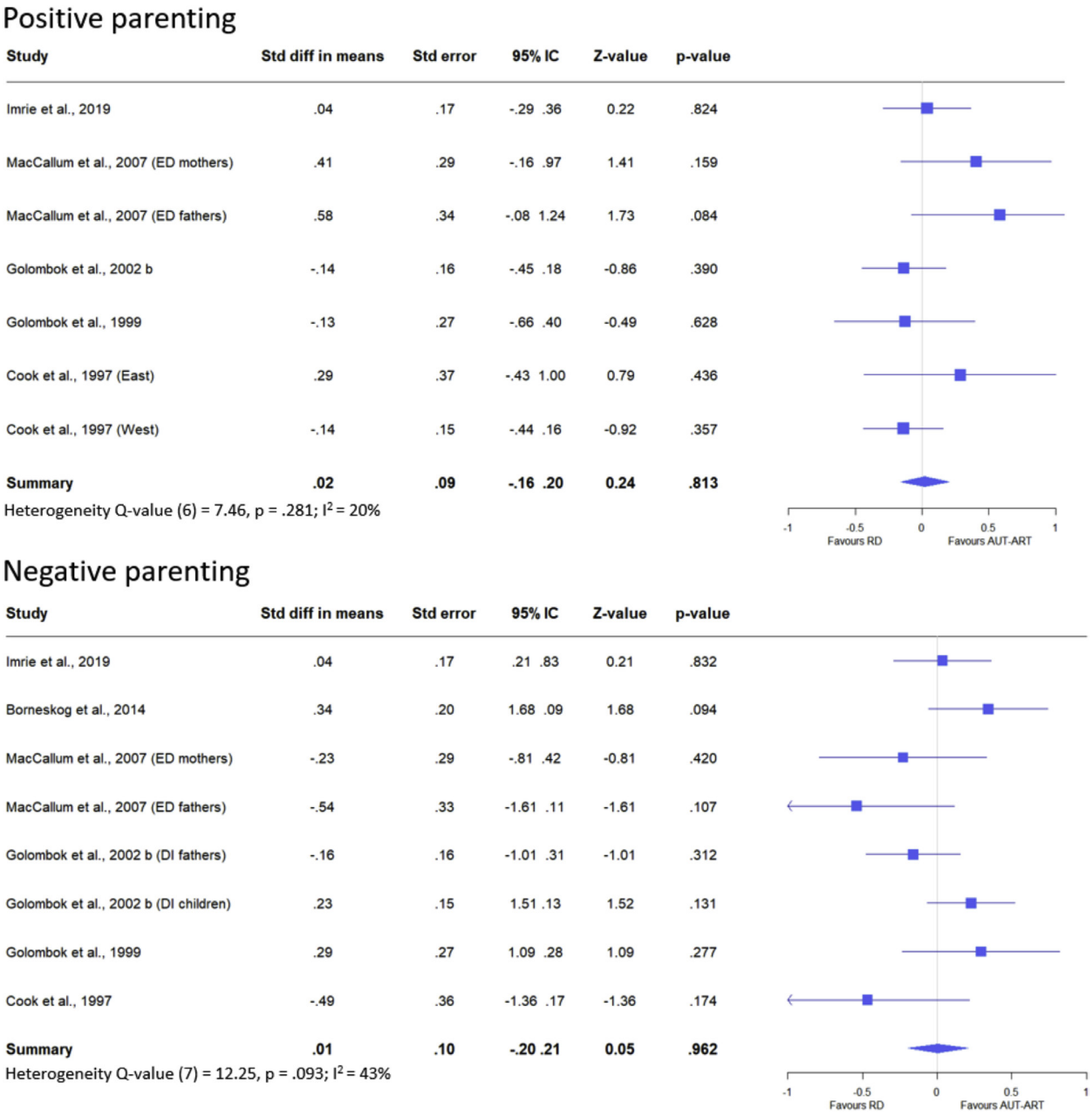

FIGURE 3 Meta-analysis of the positive and negative parenting values of parents with children without a genetic link in reproductive donation (RD) families compared with those of parents and children with a genetic link in families conceiving using autologous assisted reproduction technology (AUT-ART). Std, standard.

(*Cook et al., 1997*) ruled out donor insemination fathers from Eastern Europe from the analyses, pointing out that the social and political contexts in Bulgaria at that time (25 years ago) differed from those of other European countries. After excluding the donor insemination fathers from Bulgaria, the *I*-squared statistics for negative parenting were equal to 25.

The results show that positive parenting was higher in reproductive donation families than spontaneously conceiving families (SMD = 0.23, 95% confidence interval [CI] 0.06–0.40, $z = 2.71$, $P = 0.007$) and negative parenting was lower than in families with spontaneous conception (SMD = 0.222, 95% CI 0.061–0.383, $z = 2.70$, $P = 0.007$). No effect of the year of publication was found in either analysis ($P = 0.40$ and $P = 0.67$, respectively).

The second pair of analyses made a comparison between reproductive donation and AUT-ART families (FIGURE 3). The *I*-squared statistic showed an acceptable level of homogeneity for both positive and negative parenting (*I*-squared = 20 and 43, respectively). There were no differences for either positive (SMD = 0.02, 95% CI –0.16 to 0.20, $z = 0.24$, $P = 0.813$) or negative (SMD = 0.01, CI –0.20 to 0.21, $z = 0.05$, $P = 0.962$) parenting between reproductive donation families and AUT-ART families.

No effect of the year of publication was found in either analysis (P = 0.36 and P = .56, respectively).

Study-specific findings

Parenting in cis-heterosexual reproductive donation families versus spontaneous conception families

Nineteen studies compared donor insemination, oocyte donation and surrogate motherhood families with families with spontaneous conception. No research compared embryo donation families with spontaneously conceiving families.

Concerning positive parenting, the mothers in families with donor insemination, oocyte donation or surrogate motherhood were rated significantly higher in warmth towards their children (*Golombok et al., 1995*, *1996*, *2002a*, *2004a*, *2004b*, *2006b*; *Owen and Golombok, 2009*), interaction (*Golombok et al., 1995*, *1996*, *2006b*), pleasure in parenthood (*Golombok et al. 2002a*, *2002b*, *2004a*, *2004b*, *2005*, *2006a*) and proximity to their children (*Golombok et al., 2004a*, *2004b*; *Kovacs et al., 2013*) than the mothers who had conceived spontaneously. Donor insemination mothers scored higher on comfort with their secure base role (*Owen and Golombok, 2009*), and the women with surrogate motherhood (*Golombok et al., 2006a*) scored higher for greater competence than spontaneously conceiving mothers.

The fathers in the donor insemination, oocyte donation and surrogate motherhood groups were rated higher for warmth (*Golombok et al., 2002a*, *2002b*, *2004b*; *Kovacs et al., 2013*)**,** joy in fatherhood (*Golombok et al., 2002a*, *2002b*, *2004b*), pleasure in proximity (*Kovacs et al., 2013*) and attachment quality (*Golombok et al., 2004b*) with their children than the spontaneous conception fathers. Furthermore, fathers in the donor insemination and oocyte donation families contributed more to the child's care and tended to spend more time at home than fathers in the spontaneously conceiving families (*Golombok 1996*, *2005*).

Lower levels of positive parenting for donor insemination and oocyte donation parents compared with spontaneously conceiving parents were found in the study by Golombok and colleagues (*Golombok et al., 2011a*) for mothers' values only when the children were 7 years old; interestingly, these findings were limited to families in which disclosure had not yet occurred.

Donor insemination children scored higher on positive feelings towards their mothers, who were judged to be more affectionate and dependable than was reported by children born after spontaneous conception (*Golombok et al., 2002a*; *Owen and Golombok 2009*). Blake and co-workers (*Blake et al., 2014a*) observed that donor insemination and oocyte donation children, interviewed when they were 7 and 10 years old, reported that the level of sharing activities and interests with their mothers and the warmth felt from their fathers remained the same during this period. Conversely, the children in spontaneous conception families reported sharing fewer activities with their mothers and perceiving lower levels of warmth from their fathers.

As regards negative parenting values, mothers in the donor insemination, oocyte donation and surrogate motherhood groups recorded significantly less parental distress (*Casey et al., 2013*; *Golombok et al., 1995*, *1996*, *2004b*; *Kovacs et al., 2013*) and lower levels of conflict, anger, guilt and disappointment with their children (*Golombok et al., 2002a*, *2004b*, *2006a*) than mothers in the spontaneous conception group. Fathers in the donor insemination, oocyte donation and surrogate motherhood groups had significantly lower levels of parental distress (*Golombok et al., 2004b*, *2006a*; *Casey et al., 2013*), and donor insemination fathers also had lower levels of conflict (*Golombok et al., 2002a*, *Kovacs et al., 2013*), than the spontaneous conception fathers. Interestingly, the donor insemination fathers who perceived higher levels of social stigma scored lower levels of warmth and fostering of their children's independence (*Nachtigall et al., 1997*). In Bulgaria, where the social stigma against ART was high, mothers and fathers who had had donor insemination recorded higher stress levels than spontaneously conceiving parents, and donor insemination fathers contributed little to their children's discipline (*Cook et al., 1997*).

Overinvolvement values were significantly higher in donor insemination, oocyte donation and surrogate motherhood families than in spontaneously conceiving families, for both mothers (*Golombok et al., 1995*, *1996*, *2002a*, *2002b*, *2004a*, *2004b*; *Owen and Golombok, 2009*) and fathers (*Golombok et al., 2002b*, *2004a*, *2004b*). Golombok and co-workers (*Golombok et al., 2002b*) found that ART families (donor insemination and AUT-ART) were more frequently classified as enmeshed than parents who had spontaneously conceived. When the children were 2 years old, the oocyte donation and donor insemination mothers perceived them as more vulnerable and were more overprotective than spontaneous conception mothers (*Golombok et al., 2005*).

Children conceived using donor insemination perceived less criticism from their parents and reported less frequent disputes with their fathers than did spontaneously conceived children (*Golombok et al., 2002a*, *2002b*).

Only six studies (*Blake et al., 2014b*; *Casey et al., 2013*; *Cook et al., 1997*; *Golombok et al., 2013*, *2017*; *Ilioi et al., 2017*) showed no statistically significant differences in the outcomes of positive parenting for the reproductive donation versus spontaneous conception families, and nine studies revealed no substantial variations in negative parenting between them (*Blake et al., 2014b*; *Casey et al., 2013*; *Cook et al., 1997*; *Golombok et al., 2006b*, 2011a, 2011b, 2013, 2017; *Ilioi et al., 2017*).

Only four studies compared the mutuality values of parent–child interactions derived from direct observation in the reproductive donation and spontaneous conception families. The data revealed that the quality of interaction was less positive when the children were 7 years old in the donor insemination, oocyte donation and surrogate motherhood families than in the families with spontaneous conception **(***Casey et al., 2013*; *Golombok et al., 2011a*, *2011b*). The less positive quality of mutuality would mostly be attributable to the values recorded for mother–child interactions in the donor insemination and oocyte donation families that had not yet made a disclosure (*Golombok et al., 2011a*). When the children were 14 years old, only the adolescents informed of the method of their conception were included in the observational assessment. The families who had had reproductive donation

did not significantly differ from the spontaneously conceiving families in this study (*Golombok et al., 2017*).

Parenting in cis-heterosexual reproductive donation families versus AUT-ART families

Donor insemination, oocyte donation and embryo donation families were compared with AUT-ART families in 11 studies. No research compared families with surrogate motherhood with AUT-ART families. In four of these studies, parents and children in the donor insemination, oocyte donation and embryo donation groups did not differ significantly from the AUT-ART families for either the positive or negative aspects of parenting (*Cook et al., 1997*; *Golombok et al., 1996*, *2002b*; *Steiner et al., 2007*).

For the other studies about positive parenting, donor insemination mothers' levels of warmth and comfort with the secure base role towards their children were higher than those of AUT-ART mothers (*Owen and Golombok, 2009*). Embryo donation fathers had higher levels of warmth, sensitivity and emotional involvement than AUT-ART fathers (*MacCallum et al., 2007*, *2008*).

Mothers and fathers in the oocyte donation group scored higher than AUT-ART parents in terms of parental coordination over the child's discipline with children aged 4–8 years (*Golombok et al., 1999*). When the children were 12 years old, oocyte donation mothers reported their partners taking less of the parenting load than AUT-ART mothers (*Murray et al., 2006*).

The data collected by Imrie and collaborators (*Imrie et al., 2019*), analysing the responses of oocyte donation mothers when the children were 1 year old revealed that they were less confident than AUT-ART mothers. This finding was more evident with older mothers.

Regarding negative parenting, mothers with donor insemination or oocyte donation had significantly lower levels of parental distress than AUT-ART mothers (*Golombok et al., 1995*, *1999*). Mothers in the donor insemination group recorded more disciplinary aggression with their adolescent children than AUT-ART mothers (*Owen and Golombok, 2009*).

Only one study (*Imrie et al., 2019*) compared the mutuality values of the reproductive donation families with those of the AUT-ART families. The direct observation proved that the scores of oocyte donation mothers for the sensitive and structuring variables were significantly lower than those of the AUT-ART mothers.

Moreover, the oocyte donation children scored significantly lower in responsiveness and involvement than the AUT-ART children. Interestingly, when data from twin families were omitted from the sample, no statistically significant differences were found between mother–infant dyads in oocyte donation and AUT-ART families (*Imrie et al., 2019*).

Parenting in homosexual reproductive donation families

In lesbian donor insemination families and gay surrogate motherhood families, the quality of the relationship between the parents and children appeared to be characterized by high values of positive parenting (*Bos and Gartrell, 2010*; *Carone et al., 2018*; *Golombok et al., 2018*), low levels of negative parenting and high values of mutuality (*Carone et al., 2018*; *Golombok et al., 2018*).

Adolescents conceived using donor insemination who indicated a high level of family compatibility were rated lower on internalizing, externalizing and total problem behaviour than children who indicated a low level of family compatibility (*Bos and Gartrell, 2010*).

Only four papers compared homosexual reproductive donation families with cis-heterosexual spontaneous conception families, and only two compared them with AUT-ART families. For positive parenting values, these comparisons highlighted that in lesbian donor insemination families, biological and non-biological mothers received the same levels of score for the quality of parent–child interactions. In contrast, biological mothers recorded higher scores than fathers in cis-heterosexual donor insemination or spontaneous conception families (*Brewaeys et al., 1997*). Furthermore, in lesbian families, non-biological mothers had a higher level of parent–child interaction, child disciplining and practical childcare than spontaneous conception and donor insemination fathers (*Brewaeys et al., 1997*; *Vanfraussen et al., 2003a*).

Turning to negative parental values, parental stress levels in donor insemination lesbian and surrogate motherhood gay couples were lower than in spontaneous conception and AUT-ART cis-heterosexual couples (*Borneskong et al., 2014*). Lesbian families with donor insemination did not differ significantly from cis-heterosexual donor insemination families (*Chan et al., 1998*), and gay families with surrogate motherhood did not differ from cis-heterosexual families with surrogate motherhood (*Sydsjo et al., 2019*).

Parenting in single-parent families

No research compared the quality of parenting between women who were single mothers by choice and had donor insemination and mothers spontaneously conceiving or undergoing AUT-ART. None of the research included in this review studied surrogate motherhood in men who were single fathers by choice.

Regarding the positive aspects of parenting, single or partnered donor insemination mothers were not statistically significantly different in terms of expressed warmth, the mother's pleasure in play and the quality of interaction values (*Golombok, 2016*, *2021*).

A less sensitive response was found in women who were single mothers by choice and had donor insemination than in partnered mothers when the child was 1 year old (*Murray and Golombok, 2005a*). In contrast, parenting was more pleasurable when the children were 2 years old (*Murray and Golombok, 2005b*).

Steiner and colleagues (*Steiner et al., 2007*) and Weissenberg and co-workers (*Weissenberg et al., 2007*) specifically analysed the impact of age on motherhood; in particular Weissenberg and co-workers revealed that single mothers, with an average age of 43 years at the birth of their first child, reported higher pleasure rates in motherhood than younger single donor insemination mothers.

Regarding negative parenting values, there was a lower level of frequency of battles with the child in families where the woman was a single mother by choice and had donor insemination than in donor insemination partnered mothers (*Golombok et al., 2016*). Parental stress levels were no different between single and partnered donor insemination mothers (*Chan et al., 1998*;

Golombok et al., 2016, 2021; Murray and Golombok, 2005a, 2005b).

Mutuality did not reveal any difference in the quality of mother–child interaction between the families of single or partnered donor insemination mothers, either when children were 4–9 years old (Golombok et al., 2016) or when they were 8–10 years old (Golombok et al., 2021).

Parenting in disclosing families versus non-disclosing families

In four studies, a comparison was made between cis-heterosexual reproductive donation families who had told their children about donors or intended to (disclosing families) and families who had not and did not intend to disclose (non-disclosing families). The results of these studies revealed that the relationship between the parents and children did not differ significantly between disclosing and non-disclosing families for the levels of positive parenting (Ilioi et al., 2017; Lycett et al., 2004; Nachtigall et al., 1997).

However, examining the age at which the children had learned of their biological origins, more positive parenting in terms of maternal warmth and sensitivity and less negative parenting in terms of conflict were detected when the disclosure took place before the age of 7 years (Ilioi et al., 2017). For children in middle childhood in families where the parents had disclosed, the fathers' parenting distress levels were less in oocyte donation families (where the fathers had a genetic link with the child) than donor insemination families (where the fathers did not have such a genetic link) (Blake et al., 2014b).

Moreover, higher levels of negative parenting were seen among mothers in non-disclosing donor insemination, oocyte donation and surrogate motherhood families: in fact, the levels of maternal distress (Golombok et al., 2013) and the severity of conflicts with the children (Freeman and Golombok, 2012; Lycett et al., 2004) were greater for non-disclosing than disclosing mothers (Golombok et al., 2013).

Children who wished to have more information about the donor did not have less positive family relationships than those who were not interested in knowing about them (Slutsky et al., 2016; Vanfraussen et al., 2003b). Indeed, the more secure the attachment between the parents and children was, the more the children showed interest in the donor and perceived the experience positively (Slutsky et al., 2016; Zadeh et al., 2017).

DISCUSSION

This review examines the genetic kinship role, assessing parenting quality in reproductive donation families who resorted to third-party reproduction (donor insemination, oocyte donation, embryo donation or surrogate motherhood) compared with families whose child was genetically linked with both parents (AUT-ART and spontaneous conception).

Contrary to concerns related to the lack of a genetic link, the results of the meta-analyses indicated that reproductive donation and AUT-ART families had no significant differences in either positive or negative parenting values. Interestingly, families with reproductive donation had statistically significantly higher positive and lower negative parenting values than families who had conceived spontaneously.

These results demonstrated that the quality of parenting was not influenced by the absence or presence of a genetic link but by other factors that made the parenting experience similar between AUT-ART and reproductive donation families: the shared experience of having a child after MAR.

The awareness of not being able to have a genetically linked child and the willingness to compensate for this condition (Casey et al., 2013; Hamilton et al., 2007; Imrie et al., 2019) would be likely to lead reproductive donation parents to establish warmer and closer relationships with the child than spontaneous conception parents. Couples who persisted in fertility treatment despite failures could represent a group of individuals less affected by the everyday problems of parenting (Imrie and Golombok, 2018; McMahon et al., 2003), with strong coping skills and psychological resilience (Ranjbar et al., 2020; Repokari et al., 2005).

Furthermore, the emotional involvement of both partners and mutual collaboration in childcare found in families with reproductive donation could be predictors of the highest level of positive parenting quality (Gameiro et al., 2011; Hammemberg et al., 2008) and a lower level of parental distress (Borneskog et al., 2014; Delvecchio et al., 2015; Fisher et al., 2008) than in spontaneous conception families. Finally, pregnancy planning is necessary for reproductive donation families but does not always occur in spontaneously conceiving families. Evidence has revealed that planned pregnancies are associated with a better mother–infant relationship (Carson et al., 2013; Nelson and O'Brien, 2012).

The narrative account supported the results of the meta-analysis by highlighting in families with reproductive donation the presence of high levels of expressed warmth, enjoyment of parenting and pleasure in proximity, and low levels of conflict, anger and stress. Furthermore, in the families where the parents were likely to disclose or had already told the child of their donor conception, there were higher levels of positive parenting, mainly when disclosure occurred before the age of 7 years. Moreover, reproductive donation children who felt a more secure attachment to their parents reported being more comfortable with their donor origins.

However, parents who conceived through reproductive donation were often overinvolved compared with spontaneously conceiving parents, consistent with other studies indicating that parents could emotionally overinvest in a long-awaited child (Burns, 2010; van Balen, 1998). These results suggested that, for future research, a deeper analysis of mutual parent–child interactions should be conducted through direct observation (Agostini et al., 2020; Bos and van Balen, 2010).

The increasing number of reproductive donation families highlights that parenting is changing (Cahn, 2013; Goldberg and Scheib, 2016; Hargreaves, 2006). Hence, it is necessary to examine the characteristics of these new families in depth. The studies in this review dealing with the donation of embryos, surrogacy and single mothers had small sample sizes, and more data are needed to reach valid conclusion in these areas. Moreover, the studies mainly involved samples from UK, and the same research group carried out many of them. In the future, it would be essential to develop research involving samples from different countries to consider the impact of different cultures and legislations. Bisexual, transgender and queer parents

were not considered because there was very limited literature on this topic and it did not meet the selection criteria required in this review.

Assessing the quality of parenting in reproductive donation families is essential both due to the persistent social stigma towards non-genetic parenting and 'non-traditional' pathways to parenthood (*Goldberg et al., 2011*) and because of how parental quality affects children's well-being (*Chan et al., 1998*; *Golombok et al., 2018*).

This study provides valuable information for healthcare professionals supporting individuals facing complex and often conflicting decisions about MAR treatments and will reassure future parents about the excellent quality of the relationship they can establish with their children without a genetic link.

This investigation indicates that the relationship between parents and children is negatively affected not by the absence of a genetic link, but rather by the pathway necessary to become a parent. The elements that matter are the level of affection and emotional involvement of both parents, the level of conflict, parental distress and the decisions made regarding the disclosure of MAR. As *Daniels and Thorn (2001)* have said, MAR allows not only a woman to give birth, but also a new family to be born.

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